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DRAWS THE LINES TOO**

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National borders matter...where one draws the lines too*

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January 2010

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Abstract

The fact that crossing a political border dramatically reduces trade flows has been widely documented in the literature. The increasing number of borders has surprisingly attracted much less attention. The number of independent countries has indeed risen from 72 in 1948 to 192 today. This paper estimates the effect of political disintegration since World War II on the measured growth in world trade. We first show that trade statistics should be considered carefully when assessing globalization over time, since the definition of trade partners varies over time. We document a sizeable resulting accounting artefact, which accounts for 17% of the growth in world trade since 1948. Second, we estimate that political disintegration alone since World War II has raised measured international trade flows by 9% but decreased actual trade flows (including inter-regional trade) by 4%.

JEL classification: F1, N70.

Keywords: Trade, Borders, Political disintegration, Trade statistics.

Résumé

De nombreux articles récents montrent que le passage d'une frontière politique réduit fortement les échanges. L'augmentation du nombre de frontières et ses conséquences pour le commerce international n'ont pas fait l'objet de la même d'attention dans la littérature. Le nombre d'États souverains a pourtant augmenté de 72 en 1948 à 192 aujourd'hui. Cet article estime l'effet de la désintégration politique sur la mesure de la croissance du commerce mondial depuis la seconde guerre mondiale. Notre analyse souligne d'abord que les statistiques commerciales doivent être traitées avec prudence lorsque l'on mesure l'évolution du degré de mondialisation, car la définition des partenaires commerciaux varie dans le temps. Il en résulte un biais statistique important, qui explique 17% de la croissance du commerce international depuis 1948. Nous montrons ensuite que l'augmentation du nombre d'États souverains seule a entraîné une augmentation du commerce international mesuré de 9%, mais a en réalité diminué les échanges (incluant le commerce interrégional) de 4%.

Code JEL: F1, N70.

Mots clés: Commerce international, Frontières, Désintégration politique, Statistiques commerciales.

I Introduction

International trade has grown almost twice as fast as world income since World War II, leading to an increase in the trade to GDP ratio from 24% in 1960 to 48% in 2003. The causes of economic globalization remain surprisingly disputed (Krugman, 1995). The usual suspects put forward in the literature are decreasing transport costs and the removal of tariffs and non-tariff barriers to trade. Hummels (2007) nevertheless finds little systematic evidence documenting the decline in transport costs. He shows that, whereas air shipping experienced a sharp cost reduction between 1955 and 2004, ocean shipping, which accounts for 99% of world trade by weight, did not register such a decline.¹

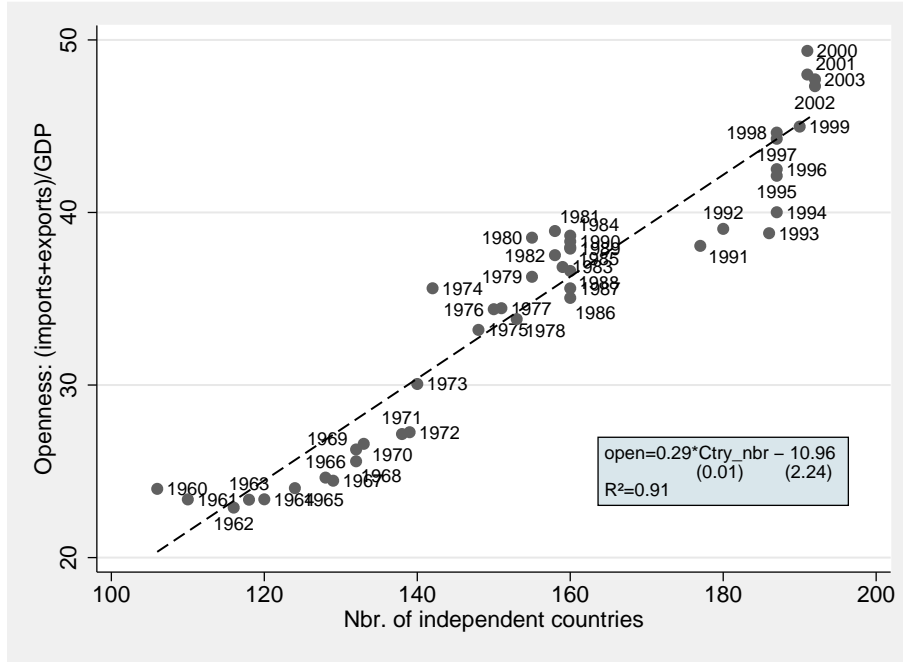
These explanations relate to the dissolution of national borders, either because of technological progress in transport and communication or of the worldwide implementation of free trade policies. A third explanation relates to the drawing of political borders. As stated by Krugman (1995, p.340), “*if international trade only includes shipments that cross the borders, it is clear that the volume of trade depends quite a lot on where one draws the line*”. In this respect, an outstanding feature of the past five decades is the increasing number of sovereign nations. The number of countries has indeed increased from 72 in 1948 to 192 today, thanks in particular to the decolonization process and the break-up of the Soviet Union. Figure 1 clearly suggests that the number of independent countries and global trade openness measured by export plus imports over GDP are correlated.² The aim of this paper is to investigate how and to what extent political disintegration has affected the volume and geography of world trade since World War II.

The break-up of nations affects international trade through three channels. On the one hand, former intra-national trade flows become international trade flows. Since these shipments existed before independence, recording them as international flows creates an *accounting artefact* in the measurement of international trade over time. Moreover, pairs of countries ever in a colonial relationship or former members of the same country share linkages and economic, cultural and institutional characteristics that make them trade more than average pairs of countries (Rose, 2000; de Sousa and Lamotte, 2007; Head *et al.*, 2007). On the other hand, the creation of political borders change relative trade costs. It creates impediments to trade - tariffs as well as non-tariffs barriers to international flows such as independent currencies or different standards and competition policies (Anderson and van Wincoop, 2004) - that dramatically reduce international trade in comparison to

¹Hummels *et al.* (2001) nevertheless show that small decreases in trade costs can lead to large increases in the volume of trade by fostering vertical specialization.

²Alesina *et al.* (2000) argue that trade liberalization leads to political disintegration because being able to trade easily with the rest of the world decreases the advantage of having a large domestic market. They link political disintegration to the level of world trade freeness, while our paper links political disintegration to the observed volume of international trade for a given level of world trade freeness.

Figure 1: Number of independent countries in the world and global trade openness



Source: World Bank and the Correlates of War project

intra-national trade (McCallum, 1995; Anderson and van Wincoop, 2003). Finally, since bilateral trade flows depend on relative trade costs (Anderson and van Wincoop, 2003), creating border barriers with some partners should increase trade with other partners. For instance, the Czech Republic would be expected to trade less with Slovakia after the break-up of Czechoslovakia, but more with any third country.

The contribution of this paper is threefold. We first provide an assessment of the growth in international trade since World War II due to the variation over time in the sample of countries recorded in the international statistics. We show that this *accounting artefact* is sizeable and accounts for one sixth in the growth of measured international trade since World War II. Part of the accounting artefact comes from the fact that the trade flows of some former colonies were not recorded at all in international statistics (neither independently nor as part of their colonizer's trade) up to their independence. Second, we investigate the impact of the creation of new political borders alone on the volume and geography of world trade since World War II. Based on a theoretically motivated gravity model of trade, we estimate world trade flows in 2005 and in a counterfactual world in 2005 with 1945 borders. We show that newly independent states trade less with former members of the same country (or their former colonizer) but trade more with the rest of the world. Overall, our empirical results suggest that political disintegration has increased measured international trade flows by 9% but decreased actual (including inter-regional)

trade flows by 4%. Third, we show that the distribution of GDP abroad affects a country's trade to GDP ratio; a country's trade openness increases when GDP abroad is distributed among a larger number of trade partners.

Several papers investigate the causes of the growth in world trade as a share of GDP. [Estevadeordal *et al.* \(2003\)](#) study the causes of the rise and fall of the trade to output ratio during the 1870-1939 period. They show that the driving forces of trade globalization were a fall in transport costs and the rise of the gold standard. [Rose \(1991\)](#) and [Baier and Bergstrand \(2001\)](#) focus on the second wave of globalization after World War II. They both work on a sample of OECD countries. [Baier and Bergstrand \(2001\)](#) show that two thirds of the growth in trade between the late 1960s and the late 1980s can be explained by income growth, 25% by a reduction in tariffs and 8% by a decline in transport costs.³ All these papers investigate the determinants of international trade growth on a subset of countries, i.e. they investigate the *intensive margin* of the growth in international trade. They cannot address the effect of the change in underlying features of the data such as the distribution of GDP among an increasing number of potential trading partners, i.e. the *extensive margin* of the growth in international trade. Yet world trade has increased by a factor of 30 between 1948 and 2007, while over the same period trade between OECD countries⁴ has increased by a factor of only 20. At the same time, the international trading system has expanded from $72 \times 71/2 = 2556$ potential bilateral trade relationships in 1948 to $192 \times 191/2 = 18336$ today. Assessing the contribution of this extensive margin to the growth in international trade requires a structural estimation of a theoretically motivated gravity model.

The paper proceeds as follows. The next section provides evidence and estimates of the accounting artefact related to variations over time in countries reported in international trade statistics. The third section presents a theoretically based gravity framework allowing the estimation of the impact of border changes on the geography and volume of world trade flows. Section 4 reports the estimation results.

II An assessment of the accounting artefact

The assessment of globalization through measured world trade depends crucially on the number of trade partners considered:

$$M_W = \sum_{i \in N} \sum_{j \in N, j \neq i} M_{ij} \quad (1)$$

³[Jacks *et al.* \(2009\)](#) confirm the prevalence of decreasing trade costs during the first wave of globalization and of income growth during the second.

⁴We exclude members that joined OECD after 1990.

where M_W denotes world imports and M_{ij} imports of i from j . Aggregate international trade depends on the set of declaring exporters and importers N . In this section, we estimate how variations over time in the sample of trade partners affect measured trade growth since World War II.

We use the declared imports in the Direction of Trade Statistics (DOTS) database of the International Monetary Fund, which provides data on bilateral merchandise trade over the period 1948-2007. The DOTS database is the main source of international trade data available over a long time span.

1 Independent states and trade partners in the DOTS

The DOTS database reports trade flows between “entities” that are not necessarily independent countries as defined by international law and practice. As put forward by Russett *et al.* (1968) and Small and Singer (1982, p38-46), in order to be registered as a state member of the international system, “*the entity must be a member of the United Nations or League of Nations, or have population greater than 500,000 and receive diplomatic missions from two major powers*”.⁵ Trade partners in the DOTS database include some territorial entities that are not independent states, and some independent states are not considered as trade partners.

Figure 2 illustrates the discrepancy between the number of independent states and the number of trade partners in the DOTS. For instance, in 2000, 191 states were recognized as sovereign nations, while 195 trade origins (i.e. entities reporting imports) were recorded in the DOTS. This discrepancy is due to the fact that some independent countries (Taiwan, Monaco, Andorra, Liechtenstein, Botswana, Lesotho, Namibia and Swaziland⁶) were not taken into account whereas some territorial entities, that were not sovereign states, were.⁷ In addition, Figure 2 underlines that the DOTS matrix is not squared, since the number of declared trade partners varies by trade origin and increases over time.

From 1948 to 2007, 120 countries became independent but only 102 new trade origins were created (Figure 2). Three quarters of these new trade origins reflect the creation of a new sovereign state, through the decolonization process (53%) and the break-up of nations (21%). The remaining 26% are related to the recognition of existing countries in 1948, such as Mongolia or Afghanistan, and territories that are still not sovereign, like the overseas territories of France, United Kingdom or the Kingdom of the Netherlands.⁸ The

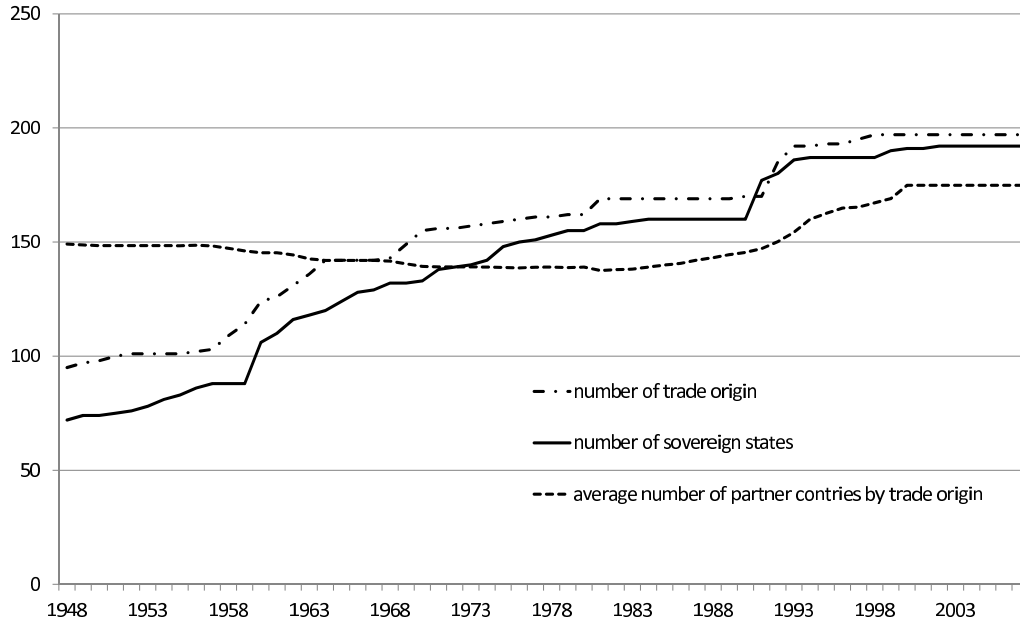
⁵“State System Membership List Codebook”, Version 2004.1 <http://www.correlatesofwar.org/>

⁶The DOTS does not consider Botswana, Lesotho, Namibia and Swaziland as trade origins but rather the South African Common Customs Area (SACCA) excluding South Africa.

⁷Aruba, Bermuda, Hong Kong, Macao, Faeroe Islands, the Falkland Islands, French Polynesia, Greenland, the Netherlands Antilles, New Caledonia and St Pierre et Miquelon.

⁸The statistical territory of a country may change over time. For instance, from 1960 to 1996, the

Figure 2: Sovereign states, trade origins and trade partners



size of the DOTS matrix has accordingly been multiplied by more than two.

The size of the DOTS matrix therefore depends to a large extent on changes in political borders over time. New independent countries, however, did not necessarily enter the DOTS in the years following their independence. Some colonies were already taken into account in the DOTS in 1948 (see Table 1). Subsequently, in half of the cases, a new independent country was recorded as a trade origin before its independence.

Table 1: Entities reporting to the DOTS in 1948 although they were not independent

Algeria 1962 (FR)	Kenya 1963 (UK)	Sierra Leone 1961 (UK)
Angola 1975 (PR)	Laos 1949 (FR)	Sudan 1956 (UK, Egypt)
Cambodia 1953 (FR)	Madagascar 1960 (FR)	Suriname 1975 (Nth)
Cameroon 1960 (FR-UN)	Malaysia 1957 (UK)	Trinidad & Tobago 1962 (UK)
Congo, D. R. 1960 (Bel)	Malta 1964 (UK)	Tunisia 1956 (FR)
Cyprus 1960 (UK)	Mauritius 1968 (UK)	Uganda 1962 (UK)
Ghana 1957 (UK)	Morocco 1956 (FR)	Vietnam 1953 (FR)
Guyana 1966 (UK)	Mozambique 1975 (PR)	Zambia 1964 (UK)
Jamaica 1962 (UK)	Nigeria 1960 (UK)	Zimbabwe 1980 (UK)

Notes: Colonizer in parenthesis. Date of independence are taken from Correlates of War Project. 2005. "State System Membership List, v2004.1"

Since 1948, the number of effective (positive) bilateral trade flows has been continuously growing and has increased more than six-fold over the period. New trade flows (i.e. involving a new trade origin and/or partner) represent an increasing share of bilateral

five French overseas departments (Guadeloupe, Guyana, Martinique, Reunion and French Guiana) were considered as distinct trade origins even if they were (and still are) part of France. On the contrary, Belgium and Luxembourg were recorded as a single trade partner from 1948 to 1996.

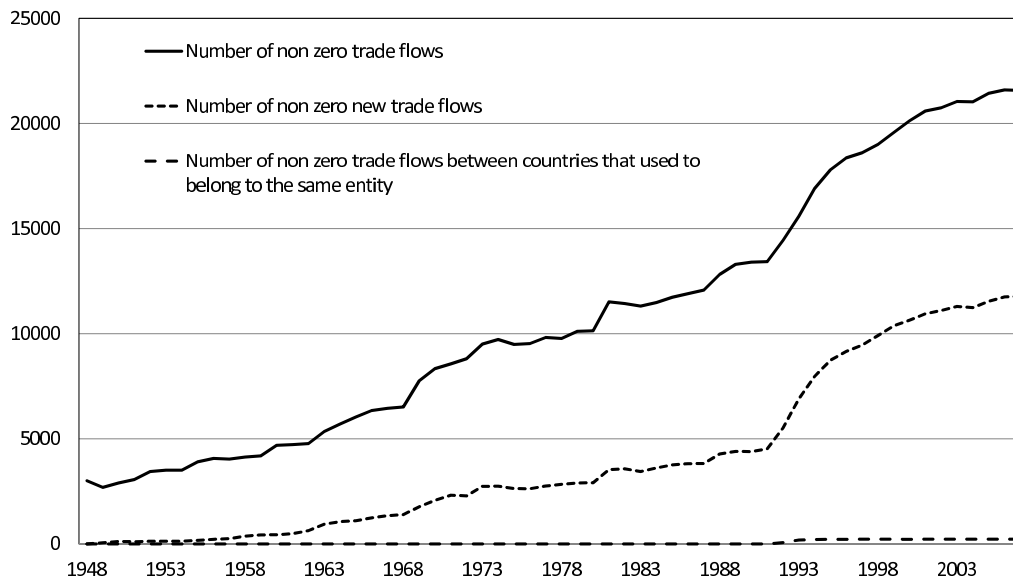
trade flows, from 4% in 1950 to 55% in 2007 (see Figure 3 and Table 2).⁹ In comparison, the share of trade flows between countries that used to belong to the same statistical entity made up 1% of world trade transactions in 2007 (see table 2). The value of trade flows involving new entities has also increased dramatically, to stand at 28% in the 2007.

Table 2: Number and value of world trade flows by decade

	Nbr of positive flows			Value of trade flows		
	Total	New	Former inter-regional flows	Total	New	Former inter-regional flows
1948	3003	0	0	55218.61	0	0
1950	2900	116	0	50578.26	418.80	0
1960	4692	435	0	112086.70	2807.52	0
1970	8336	2072	0	293407.60	12778.69	0
1980	10133	2907	2	1856672.00	146440.30	110.8
1990	13402	4394	2	3345372.00	313067.50	108.2198
2000	20130	10636	220	6205497.00	1228920.00	48701.5
2007	21566	11783	226	13500000.00	3834935.00	161052.6

Notes: Authors' calculations on the basis of DOTS.

Figure 3: Number of trade flows from 1948 to 2007



⁹Felbermayr and Kohler (2006) show that the share of positive trade flows in the total number of flows has remained fairly constant over time and distinguish the contribution of new flows between existing trade origin in 1948 and flows involving a new trade origin.

2 Estimating the accounting artefact

Whatever its cause, the creation of a new trade origin or trade partner in the DOTS automatically increases the world trade matrix and thus international trade. Two cases should nevertheless be distinguished regarding the statistical artefact which is generated on the measurement of international trade.

In the general case of a country break-up, former inter-regional trade flows become international flows because former regions of the same country become sovereign nations.¹⁰ For instance, the break-up of Czechoslovakia in 1993 resulted in the creation of two new countries: the Czech Republic and Slovakia. Czechoslovakian trade, however, included the trade of all its regions with the rest of the world. In this case, we thus define trade flows between the Czech Republic and Slovakia (i.e. USD 4882 millions in 1993) as a statistical artefact since they existed before independence but were not recorded in the DOTS.

A country's independence may nevertheless have more severe consequences on the measurement of international trade. The trade of some independent states, territories or colonies was simply not recorded at all in international trade statistics before their independence or their creation as a trade origin. In this case, all trade flows of these countries contribute to the accounting artefact since they existed but were not recorded in 1948 and appeared in international statistics between 1948 and 2007. To illustrate the relevance of this second source of accounting artefact, let's consider the case of the former French West and Equatorial African colonies, whose trade flows were simply not included in the DOTS database even as part of the French imports or exports.¹¹ Table 3 shows that in 1962 these countries represented 4.25% of French foreign trade and that, from 1959 to 1962, their independence and creation as a trade origin accounted for 13.4% of the increase in French trade. In addition, although they represented less than one percent of world trade in 1962, their creation accounted for almost 4% of the increase in the value of world trade flows between 1959 and 1962.

The accounting artefact is sizeable also at the world level. In order to assess the bias introduced in world trade statistics by the creation of new trade origins and trade partners, we compute the share of the growth in world trade due to flows that were not recorded as international trade flows in 1948. More precisely, we subtract from the total value of imports recorded in the DOTS since 1948 the total value of trade between country pairs

¹⁰As mentioned previously trade origins in the DOTS are not necessarily independent states, and their definition has changed over time. Such changes are not neutral in term of measured international trade. For instance, from 1948 to 1996 Belgium and Luxembourg were considered as a single trade partner. In 1997, these two countries were for the first time considered as distinct trade partners, and their bilateral trade recorded in the DOTS.

¹¹The French Customs and Excise Department (1959) defines the French statistical territory as continental France (including the free zones of *pays de Gex* and *Haute-Savoie*), Corsica, Monaco and Sarre.

Table 3: Impact on French and world trade of the independence of French Western and Equatorial Africa (1959-1962)

	% of the value of French trade 1962	% of French trade increase (1959-1962)	% of the value of world trade 1962	% of world trade increase(1959-1962)
Benin	0,16	0,49	0,03	0,12
Burkina Faso	0,09	0,29	0,03	0,16
Central African Rep..	0,08	0,25	0,00	0,00
Chad	0,12	0,39	0,04	0,17
Congo, rep. of	0,28	0,90	0,04	0,38
Côte d'Ivoire	1,26	3,99	0,28	1,28
Gabon	0,37	1,17	0,08	0,36
Mali	0,10	0,30	0,01	0,04
Mauritania	0,19	0,60	0,03	0,14
Niger	0,14	0,43	0,03	0,15
Senegal	1,46	4,59	0,22	1,02
Total	4,25	13,39	0,83	3,81

Notes: Authors' calculations on the basis of DOTS.

that were not recorded in the DOTS trade matrix in 1948. Our definition includes country pairs that used to belong to the same country (e.g. Czech Republic and Slovakia) and country pairs that were not recorded in 1948 either because the importer was not recorded as a trade origin in the DOTS in 1948 (e.g. Afghanistan, Mali) or because the exporter was not declared as a trade partner by a particular trade origin. Note that our definition of the accounting artefact is restrictive since we consider as existing all country pairs recorded in the DOTS in 1948, including those for which a zero or missing value is reported in 1948 (79% of observations).¹² Accordingly, our quantification of the accounting artefact excludes the 'real' extensive margin, i.e. zero trade flows between existing country pairs in 1948 that subsequently turned positive.

Results in Table 4 confirm that the accounting artefact is sizeable: it accounts for more than one sixth of the growth in world trade since World War II. The accounting artefact was particularly significant in the 1950s and 1960s due to the decolonization process and in the 1990s due to the break-up of the Soviet Union.¹³ Overall, 17% of world trade growth since 1948 is related to the inclusion of new trade origins in the DOTS database.

This section shows that variations over time in the number and definition of trade origins and partners in international trade statistics inflate the measured growth in international trade. As underlined above, the creation of a new trade origin does not necessarily reflect the recognition of a new sovereign state. Moreover, changing political borders may

¹²Gleditch (2002) argues that many zeros in the DOTS are problematic and should be treated as missing observations.

¹³Note that the German reunification has had no effect on the accounting artefact since trade flows between the Federal Republic of Germany and the German Democratic Republic was null before reunification.

Table 4: Assessing the accounting artefact

	Value of trade flows (millions of constant USD)		Artificial trade creation (share of total trade growth)	
	total	artefact	cumulative	by decade
1948	229123	0		
1959	334141	8334	7.9	7.9
1960	378671	9459		
1969	690125	30266	6.6	3.2
1970	756205	32844		
1979	2095359	162439	8.7	0.9
1980	2253243	174605		
1989	2381311	235550	10.9	2.0
1990	2559581	236689		
1999	3308888	335612	10.9	9.5
2000	3603657	395374		
2007	6510982	1083380	17.2	0.3

Notes: Authors' calculations on the basis of DOTS. The last column reports the statistical artefact related to new trade origins/partners created during the decade only.

affect trade with third countries. Fully quantifying the contribution of changing political borders on the growth in world trade therefore requires to go beyond simple descriptive statistics and to structurally estimate a trade model. In the next section, we investigate the impact of changing political borders on the volume and geography of world trade based on a micro-founded gravity model of trade à la [Anderson and van Wincoop \(2003\)](#).

III The gravity model and borders

The gravity model of trade is based on two building blocks ([Anderson and van Wincoop, 2003](#)). Consider first N countries/regions each specialized in the production of one good differentiated by place of origin. We assume the supply of each good to be fixed. Let then add identical, homothetic preferences represented by the following CES utility function:

$$U_j = \sum_{i \in N} c_{ij}^{(\sigma-1)/\sigma} \quad (2)$$

where c_{ij} is consumption of goods produced in country i by consumer of country j and σ is the elasticity of substitution between all goods. Country j 's consumers maximise (2) subject to the budget constraint:

$$\sum_{i \in N} p_{ij} c_{ij} = y_j \quad (3)$$

where p_{ij} is the price of goods produced in country i for country j 's consumers and y_j is country j 's nominal income.

Let t_{ij} be the variable trade costs on exports from i to j . Then $p_{ij} = p_i t_{ij}$ where p_i is country i 's supply price. The value of exports from country i to country j is $x_{ij} = p_{ij} c_{ij}$ and total income of country i is $y_i = \sum_{j \in N} x_{ij}$.

Maximization of (2) subject to (3) yields:

$$x_{ij} = \left(\frac{p_i t_{ij}}{P_j} \right)^{1-\sigma} y_j \quad (4)$$

where P_j is given by:

$$P_j = \left(\sum_{i \in N} (p_i t_{ij})^{1-\sigma} \right)^{1/(1-\sigma)}. \quad (5)$$

Market clearance implies:

$$y_i = \sum_{j \in N} x_{ij} = p_i^{1-\sigma} \sum_{j \in N} \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} y_j. \quad (6)$$

Following [Anderson and van Wincoop \(2003\)](#), using (6) to solve for the unknown prices p_i together with (4) and (5), we obtain:

$$x_{ij} = \frac{y_i y_j}{y_w} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (7)$$

where

$$\Pi_i^{1-\sigma} = \left(\sum_j \frac{y_j}{y_w} \frac{t_{ij}}{P_j} \right)^{1-\sigma} \quad (8)$$

$$P_j^{1-\sigma} = \left(\sum_i \frac{y_i}{y_w} \frac{t_{ij}}{\Pi_i} \right)^{1-\sigma}. \quad (9)$$

1 World openness under free trade

Under free trade, i.e. without transport costs or tariffs so that prices are identical for all countries, bilateral trade is determined by the product of the two countries' GDPs. The analysis of world trade is then straightforward: global trade openness depends only on the size distribution of countries. Since prices are identical for all countries, we normalize them to unity: $p_{ij} = 1 \forall i, j$. We thus have:

$$x_{ij} = \frac{y_i y_j}{y_w} = x_{ji}. \quad (10)$$

In this framework, [Helpman \(1987\)](#) shows that, for a group of countries A , the fraction

of GDP traded inside the region is defined by:

$$\frac{T_A}{Y_A} = s_A \left(1 - \sum_{i \in A} (s_{iA})^2 \right) \quad (11)$$

where T_A is the volume of intra-regional trade, Y_A is the regional GDP, s_A is the share of region A in world GDP and s_{iA} are the share of region A 's GDP of each country i in region A . At the world level, [Helpman \(1987\)](#)'s equation yields:

$$\frac{T_W}{Y_W} = \left(1 - \sum_{i \in N} (s_i)^2 \right) \quad (12)$$

where T_W is the volume of world trade, N is the total number of countries in the world and s_i is i 's share of world GDP. The last term on the right hand side of (12) is a “size dispersion index”. The latter is minimized for N identical countries whose share of world GDP is $\frac{1}{N}$. Hence, under free trade, the relationship between global trade openness and the number of independent countries is straightforward: an increase in the number of countries increases the share of world production traded internationally by decreasing the “size dispersion index”.

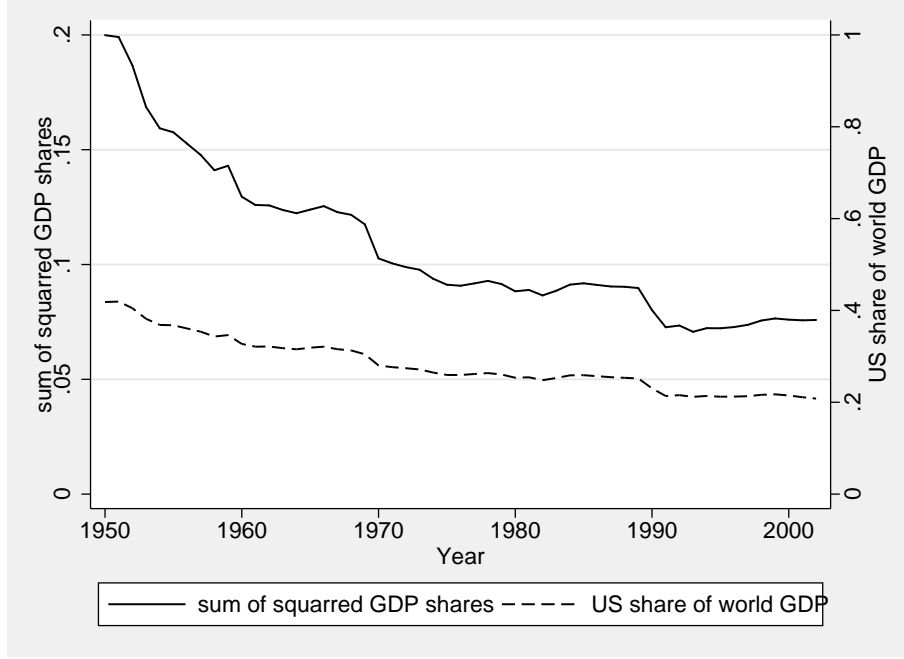
Figure 4 plots the evolution between 1950 and 2002 of the sum of the squared share of world GDP of independent countries and the US share of world GDP. It confirms that the size dispersion index has been declining since World War II, thanks in particular to the sharp decline of the US share of global GDP. The world with which the US were trading in 1950 was with an outside world slightly larger than itself but is now five times larger.

2 Gravity with trade barriers

With transport costs, the analysis is less straightforward since bilateral trade depends on relative trade costs ([Anderson and van Wincoop, 2003](#)). Any change in bilateral trade costs between two countries therefore affects the trade flows of each country with its other partners. A country break-up creates border barriers between former regions of the same country. This has two effects on international trade. First, it reduces actual trade flows between the two new independent countries but increases recorded international trade flows since trade between regions is not recorded as international trade before independence. Second, it increases the average trade barriers that new countries face with all their trading partners. A new independent country should thus trade less with the former regions of the same country but trade more with other partners.

As underlined by [Feenstra \(2004\)](#) and [Anderson and van Wincoop \(2003\)](#), equation (7)

Figure 4: Size distribution of countries



Source: Penn World Table 6.2

can be properly estimated using country fixed effects that account for inward and outward multilateral resistance terms Π_i and P_j . We can therefore consistently estimate the effect of national independence on trade between two former members of the same country from (7). However, to assess the effect of country break-ups on trade with other partners, we need to compute the multilateral resistance terms from (8) and (9).

Assuming symmetric trade barriers, $t_{ij} = t_{ji}$, we have $\Pi_i = P_i$, and:

$$P_j^{1-\sigma} = \sum_i P_i^{\sigma-1} \frac{y_i}{y^w} t_{ij}^{1-\sigma} \quad \forall j. \quad (13)$$

We assume the following trade cost function:

$$\ln t_{ij} = \ln \text{dist}_{ij} + \sum_h \alpha_h z_h. \quad (14)$$

The vector of observable bilateral linkages affecting trade costs includes variables measuring geographical, cultural and historical proximity as well as trade policy variables:

$$Z_{ij} = [\text{Contig}_{ij}, \text{Lang}_{ij}, \text{Smctry}_{ij}, \text{Colony}_{ij}, \text{ComCol}_{ij}, \text{Comcur}_{ij}, \text{RTA}_{ij}, \text{WTO}_{ij}] \quad (15)$$

where Contig_{ij} , Lang_{ij} and Comcur_{ij} are dummies for countries sharing a common border, a common official language and a common currency respectively. RTA_{ij} and WTO_{ij}

measure common membership of a regional trade agreement and the World Trade Organization, and $Smctry_{ij}$, $Colony_{ij}$ and $ComCol_{ij}$ are dummies equal to 1 for, respectively, regions of the same country, countries ever in a colonial relationship and sharing a common colonizer since World War II.

So we have:

$$P_j^{1-\sigma} = \sum_i P_i^{\sigma-1} \frac{y_i}{y^w} \exp^{\beta_1 \ln dist_{ij} + \sum_h \beta_h z_h} . \quad (16)$$

The β 's coefficients in (16) may be consistently estimated from (7). We may then solve the vector of $P_j^{1-\sigma}$ using the system of N goods market equilibrium conditions (16), estimated coefficients from (5) and GDP shares. We are thus able to estimate the impact of the establishment of a political border on trade with former regions of the same country and with the rest of the world.

IV Empirics

Our empirical strategy consists of three steps. First, we need to estimate the impact of the components of the trade cost vector using a gravity equation with country fixed effects. Second, we solve the vector of $P_j^{1-\sigma}$ using the system of N goods market equilibrium conditions (16). Then we estimate bilateral trade flows in 2005 and for a counterfactual world in 2005 with 1945 borders. To be clear about our approach, our aim is not to compare world trade flows in 2005 to those in 1945 but world trade flows in 2005 to those that would have prevailed, all other things being equal, in 2005 should the political borders have remained the same as in 1945.

1 Data

Trade flows are taken from the *Direction of Trade Statistics* (DOTS) database of the International Monetary Fund. GDP data are from the World Bank's *World Development Indicators* (WDI). The data on regional trade agreements originates from Vicard (2009) and data on currency unions are an extended version of Glick and Rose (2002) available at <http://jdesousa.univ.free.fr/data.htm>. Data on geographical distances and common official language come from the CEPII database¹⁴. The data on sovereign nations and colonial relationships are taken from the Correlates of War project¹⁵ and completed by the CIA *World Factbook*. We consider countries that had a direct colonial link and

¹⁴<http://www.cepii.fr/francgraph/bdd/distances.htm>

¹⁵Correlates of War Project. 2005. "State System Membership List, v2004.1" and "Colonial/Dependency Contiguity Data, 1816-2002. Version 3.0." <http://www.correlatesofwar.org/>.

countries that used to belong to the same country (Czech Republic and Slovakia) as a single category ($Colony_{ij}$). We define a second category for countries sharing a common colonizer ($ComCol_{ij}$).¹⁶

2 Same country effect

In this section, we take advantage of the discrepancy between sovereign nations and entities in the DOTS to estimate the impact on bilateral trade of belonging to the same country. In 2005, the DOTS database reports trade flows for 20 entities that are not sovereign states.¹⁷

Substituting trade costs (14) into (7) and log-linearizing, we obtain the following econometric model:

$$\ln x_{ij} = \beta_1 \ln dist_{ij} + \beta_2 Contig_{ij} + \beta_3 Lang_{ij} + \beta_4 Smctry_{ij} + \beta_5 Colony_{ij} + \beta_6 ComCol_{ij} + \beta_7 Comcur_{ij} + \beta_8 RTA_{ij} + \underbrace{\gamma_1 \ln y_i + \gamma_2 P_i}_{I_i} + \underbrace{\gamma_3 \ln y_j + \gamma_4 P_j}_{E_i} + \varepsilon_{ij} \quad (17)$$

where I_i and E_i are importer's and exporter's fixed effects and ε_{ij} is the error term.

The estimation of (17) by OLS may indeed yield biased estimates: because of Jensen's inequality ($E(\ln \varepsilon) \neq \ln E(\varepsilon)$). Santos Silva and Tenreyro (2006) show that estimating gravity equations in the standard log-linear form yields biased parameter estimates. They suggest using a Poisson quasi maximum likelihood (PQML) estimator, which yields consistent estimates in the presence of heteroscedasticity. The PQML technique also enables us to avoid dropping zero trade values, which represent 31% of observations in our dataset. We thus estimate (17) in exponential form on a cross-section in 2005 using a PQML estimator.

Results are presented in column (1) of Table 5. The coefficients on standard gravity variables are in line with the literature. The coefficient on the common colonizer dummy is however not significant. Since we work on a cross-section in 2005, colonial business linkages may have vanished since independence (Head *et al.*, 2007). However, when we include a dummy for countries sharing a common colonizer and still in an ongoing colonial

¹⁶These definitions slightly differ from those adopted in Rose (2000) or Head *et al.* (2007). For instance, Mali and Côte d'Ivoire were part of French West Africa before their independence. Each of them had a direct colonial link with France, but they were also part of the same territorial entity. Mali and Côte d'Ivoire are accordingly included in $Colony_{ij}$ instead of $ComCol_{ij}$.

¹⁷These entities are small and remote from the rest of the country they belong to. Our results should accordingly not be regarded as an estimation of the border effect put forward by McCallum (1995) and Anderson and van Wincoop (2003) using data on Canadian provinces and US States. They are however much more representative of the "border effect" between colonies and colonizer, since most colonies were also small and remote from their colonizer.

relationship, its coefficient is also insignificant, confirming the insignificance of common colonial history for trade relationships after independence. The inclusion of country fixed effects controlling for legal origin may however partially explain this result. Finally, the insignificant coefficient on the common currency dummy may reflect the fact that we consider the euro together with other common currencies without a long panel dataset (Frankel, 2008).

Table 5: Gravity results

	(1)	(2)	(3)
Dependent var.	M	$M > 0$	$\log(M)$
Estimator	Poisson	QML	OLS
Current colonial relationship dum.	0.96 ^c (0.51)	0.89 ^c (0.49)	1.53 ^a (0.41)
Ever in a colonial relationship or part of the same country dum.	1.01 ^a (0.10)	0.98 ^a (0.10)	2.16 ^a (0.10)
Common colonizer dum.	-0.02 (0.16)	-0.03 (0.16)	0.75 ^a (0.07)
Contiguity dum.	0.54 ^a (0.07)	0.55 ^a (0.07)	0.56 ^a (0.10)
Log distance	-0.79 ^a (0.03)	-0.79 ^a (0.03)	-1.66 ^a (0.03)
Common language dum.	0.17 ^a (0.06)	0.17 ^a (0.06)	0.66 ^a (0.05)
Common currency dum.	0.04 (0.08)	0.04 (0.08)	-0.07 (0.13)
RTA dum.	0.27 ^a (0.06)	0.27 ^a (0.06)	0.25 ^a (0.05)
WTO membership dum.	0.36 ^b (0.16)	0.42 ^a (0.16)	1.04 ^a (0.14)
Observations	29721	20457	20457
R-squared	0.92	0.92	0.73

Notes: a, b, c denotes significance at the 1, 5 and 10% level.
Heteroscedasticity-robust standard errors are in parenthesis.

Countries that have ever been in a colonial relationship or part of the same country since 1945 trade 175% more than other country pairs, while regions currently in a colonial relationship trade on average $e^{1.01+0.96} - 1 = 616\%$ more.¹⁸ Our estimates are conservative with respect to the literature exploring the impact of colonial history and country break-up on trade. Rose (2000) shows in his benchmark results for 1990 that the colonial relationship raises bilateral trade by a factor of 5.75, all other things being equal, while having had a common colonizer makes countries bilateral trade 80% larger. Papers dealing directly with the break-up of nations or colonial empires show that country break-up dra-

¹⁸The colonial relationship dummy is also set to 1 for countries in an ongoing colonial relationship.

matically decreases bilateral trade. For instance, [Fidrmuc and Fidrmuc \(2003\)](#) find that, at the time of their independence, the Czech Republic and Slovakia were trading 43 times more together than with third countries. Five years later, this ratio had been reduced to 7. [de Sousa and Lamotte \(2007\)](#) nevertheless moderate this conclusion with a larger set of countries including Czechoslovakia, the Soviet Union and Yugoslavia. Examining the effect of independence on post-colonial trade, [Head *et al.* \(2007\)](#) conclude that independence gradually reduces colonial trade, by damaging business networks or institutions. On average, trade between a colony and its colonizer is reduced by two-thirds after 30 years of independence, from an initial level of trade on average 13.5 times larger than trade between other countries. This discrepancy may come from the fact that we use a PQML estimator to deal with the fact that the variance of the error term may be correlated with explaining variables in the log-linearized gravity equation, while other papers implement OLS.¹⁹ Results using OLS confirm this explanation (column (3) of Table 5), since the effect of belonging to the same country is found to be five times larger.²⁰

3 Multilateral resistance terms

In this section, we compute the multilateral resistance terms using the system of goods market-equilibrium conditions (16) and the trade costs estimated from equation (17).²¹ Multilateral resistance terms are critical for analyzing the effect of new political borders on trade with third countries. P_i indeed measures the average trade barriers faced by country i . Since creating a political border between two regions i and j increases bilateral trade and therefore average trade costs of both countries, it is relatively easier for third countries to trade with countries i and j .

We have complete data for 181 countries, of which 448 pairs have been part of the same country or in a colonial relationship since 1945. For each country, computing (16) requires data on all trade partners, including the country itself. A difficulty here is to measure internal distance ([Head and Mayer, 2002](#); [Redding and Venables, 2004](#)). We use 3 different measures of internal distance. First, we consider intra-national distance as the distance to the nearest neighbor divided by four ([Wei, 1996](#); [Anderson and van Wincoop, 2003](#)). Second, we compute distance as $dist_{ii} = 0.67\sqrt{area/\Pi}$, which measures the average distance between producers and consumers in a country considered as a circle. Finally, we compute distances based on bilateral distances between the largest cities weighted by

¹⁹Note that the difference in the definition of the dummy for current and past colonial relationships does not drive this result.

²⁰The selection bias due to the exclusion of zero trade flows when using OLS is not significant (column (2) of Table 5).

²¹Computationally, we solve (16) for $P_i^{1-\sigma}$ so that we do not need estimates of elasticity of substitution σ .

their population (Head and Mayer, 2002).²² The measurement of internal and international distances is consistent with this weighted measure of distance. The common border, common language, and the same country and colonial relationship dummies are also set to unity for intranational trade costs. We compute trade costs from (14) for the year 2005 and for our counterfactual world for each of the internal distance measures.²³

The level of multilateral resistance $P^{\sigma-1}$ is, as expected, lower for large countries such as the United States and Japan, and countries surrounded by other rich countries, such as EU countries (see appendix) or small and rich countries with large neighbors (Singapore, Hong-Kong). Conversely, small countries and remote islands face the largest multilateral resistances. The level of $P^{\sigma-1}$ depends on the measure of internal distance used. Wei (1996)'s measure of internal distance places more weight on domestic GDP and reduces $P^{\sigma-1}$ for rich countries and increases it for poor countries. The opposite is true for the measure of internal distance based on domestic area. Weighted distance increases $P^{\sigma-1}$ for all countries with respect to Wei (1996)'s measure, but more for small and remote countries. The ranking of $P^{\sigma-1}$ however changes only at the margin. Large countries, like the United States, have relatively larger internal distance with area based and weighted distance measures than with Wei (1996)'s measure, and have a relatively larger multilateral resistance compared to smaller countries like Japan.

The effect of our counterfactual exercise on multilateral resistance depends on the kind of countries considered (see appendix). Switching to 1945 borders decreases multilateral resistance in former colonies and former regions of a large country. The decrease is large for countries close to their former colonizer (Papua New Guinea, Namibia) or the former regions of the same country (former members of the USSR). Conversely, OECD countries exhibit no change in $P^{\sigma-1}$. France and the UK are exceptions since they experience a small decrease in their multilateral resistance, due to the removal of border barriers with their former colonies. Since former colonies are small and remote, removing border barriers with them has a limited impact on French and English average trade costs. Russia also exhibits an increase in its multilateral resistance. These results are basically similar for all three measures of internal distance.

²²The general formula is $dist_{ij} = \sum_{k \in i} (pop_k / pop_i) \sum_{l \in j} (pop_l / pop_j) dist_{kl}$ where pop_k is the population of agglomeration k belonging to country i and $dist_{kl}$ is the geodesic distance between agglomeration k and l .

²³When weighted distance is used to measure internal distance, we also re-estimate (17) using weighted international distance and use the estimated coefficients on trade costs. Results are presented in Table 7 in Appendix A.

4 Estimation of world trade

In this final section, we estimate trade flows for our sample of 181 countries in 2005 and for our counterfactual world.²⁴ More specifically, we compute:

$$\ln \tilde{x}_{ij}^h = \ln \left(\frac{y_i y_j}{y_w} \right) - 0.79 \ln dist_{ij} + 0.54 Contig_{ij} + 0.17 Lang_{ij} + 0.96 Smctry_{ij}^h + 1.01 Colony_{ij}^h + 0.27 RTA_{ij} + 0.36 WTO_{ij} + (\sigma - 1) \ln \tilde{P}_i^h + (\sigma - 1) \ln \tilde{P}_j^h, \quad h = \{a, c\} \quad (18)$$

where $h = a$ stands for the actual world in 2005 and $h = c$ for our counterfactual world. \tilde{x}_{ij}^h is the predicted trade flow from i to j and $Smctry_{ij}^h$ and $Colony_{ij}^h$ are respectively regions of the same country and countries ever in a colonial relationship since World War II in each state of the world. \tilde{P}_i^t have been computed in the preceding section.

Results using each of the three measures of internal distance are presented in table 6. The results are qualitatively similar for all three measures of internal distance. We thus focus our discussion on the simplest measure, the Wei (1996) measure of internal distance. Predicted trade flows in 2005 exhibit a fairly good fit; when compared to the 25675 observations for which we actually have trade data, the R-squared is 0.64.²⁵

Changing political borders affects both the volume and the geography of trade flows. Our results show that international trade, i.e. flows crossing a border, is 9% larger in 2005 than what it would have been with 1945 borders. The increase in the number of independent countries since WWII has led to a sizeable increase in measured international trade.

The picture is however different when we consider all trade flows, i.e. trade flows between the 181 countries for which data are available, irrespective of whether they cross a border or not. In 2005, all these countries are independent, so that all their trade flows are recorded as international trade. In our counterfactual world, 13% of trade takes place between regions of the same country or a colonizer and its colonies, and is not recorded as international trade. When all trade flows are considered, total trade in 2005 is 4% lower than what it would have been with 1945 borders. Increasing the number of independent countries therefore increases the measured international trade by increasing the number of flows recorded as international trade, but it reduces the volume of these flows by creating new border barriers.

As regards the geography of world trade, trade between former regions of the same country and between colonizers and their colonies in 2005 is half its value in our counterfac-

²⁴German reunification is not taken into account here since Germany was divided into the Federal Republic of Germany and the German Democratic Republic in 1949.

²⁵We calculate R-squared as the squared correlation between the observed and the predicted bilateral exports.

tual world. The presence of new border barriers between these countries also affects their exchanges with the rest of the world because it increases their average trade barriers. In the aggregate, former regions of the same country and colonizers and their colonies trade 1.9% more with third countries. A country's break-up therefore affects third countries' trade.

Finally, trade between OECD countries is only marginally affected by new political borders. France and the UK are exceptions since their bilateral trade is estimated to have increased by 2% thanks to the decolonization process. In the aggregate, French and English trade with the rest of OECD countries is 1% larger in 2005 than in our counterfactual world.

Table 6: Estimations of world trade in 2005 and in the counterfactual world

	Internal distance measure		
	Wei	Area	Weighted
International trade (counterfactual/2005)	0,918	0,928	0,917
Total trade (counterfactual/2005)	1,040	1,017	1,041
Non colonial trade (counterfactual/2005)	0,981	0,977	0,981
Colonial trade (counterfactual/2005)	1,893	1,769	1,895
Colonial trade*/international trade (counterfactual)	0,132	0,096	0,136
Colonial trade/international trade (2005)	0,064	0,050	0,066
Mean x	3,81E+08	3,81E+08	3,81E+08
Mean estimated x (2005)	2,16E+08	4,90E+08	3,97E+08
R-squared	0,64	0,64	0,63

Notes: Computed from specification (1) in Table 5 for the Wei and area distance measures, and from specification (1) in Table 7 for the weighted distance measure.

*Trade between colonizers and their colonies and regions of the same country.

V Conclusion

This paper investigates how the process of political break-up since World War II - the number of sovereign states has risen from 72 in 1948 to 192 today -, directly affects the volume and the geography of international trade. We first show that variation over time in the number of trade origins/partners recorded in international trade statistics create an accounting artefact in the measurement of world trade growth. Trade flows between regions of the same country in 1948 were indeed not recorded and, in the case of several colonies and countries, trade was simply not recorded in 1948. These discrepancies in the sample of countries included in the DOTS accounts for 17% of the growth in international trade between 1948 and 2007.

Second, we lay out an empirical strategy to investigate the impact of country break-ups on world trade based on a structural estimation of a gravity model of trade à la [Anderson and van Wincoop \(2003\)](#). We find that the rise in the number of independent countries since WWII has increased international trade by 9%, by raising the number of flows recorded as international trade, i.e. flows crossing a political border. It has however reduced total trade by 4%, i.e. including trade between former regions of the same country and former colonizers and their colonies, because new political borders create border barriers. Our results emphasize that the extensive margin of world trade related to the recognition of new sovereign states has a sizeable impact on the measurement of world trade growth since WWII. Our paper thus complements the results of [Baier and Bergstrand \(2001\)](#) on the determinants of the intensive margin of the growth in world trade.

This paper shows that the distribution of world GDP across sovereign political entities and their number matter for the measurement of trade openness. It suggests to be cautious when measuring trade globalization only by the trend in the trade to GDP ratio, without taking into account the number of potential trading partners in the world.

Appendix A

Table 7: Gravity results: weighted distance

Estimator	(1)	(2)	(3)
	X Poisson	$X > 0$ QML	log X OLS
Current colonial relationship dum.	0.97 ^c (0.50)	0.90 ^c (0.49)	1.52 ^a (0.41)
Ever in a colonial relationship or part of the same country dum.	1.02 ^a (0.09)	0.99 ^a (0.09)	2.16 ^a (0.09)
Common colonizer dum.	0.06 (0.13)	0.06 (0.14)	0.71 ^a (0.07)
Contiguity dum.	0.47 ^a (0.06)	0.47 ^a (0.06)	0.62 ^a (0.10)
Log distance	-0.89 ^a (0.04)	-0.89 ^a (0.04)	-1.75 ^a (0.03)
Common language dum.	0.19 ^a (0.06)	0.19 ^a (0.06)	0.65 ^a (0.05)
Common currency dum.	-0.18 ^b (0.08)	-0.18 ^b (0.08)	-0.08 (0.13)
RTA dum.	0.30 ^a (0.07)	0.30 ^a (0.07)	0.21 ^a (0.05)
WTO membership dum.	0.40 ^b (0.17)	0.46 ^a (0.17)	1.00 ^a (0.14)
Observations	29368	20289	20289
R-squared	0.92	0.92	0.73

Notes: a, b, c denotes significance at the 1, 5 and 10% level.
Heteroscedasticity-robust standard errors are in parenthesis.

Appendix B

Table 8: Multilateral resistance terms $P^{\sigma-1}$ in 2005 and in the counterfactual world (CF)

Internal Distance Country	Wei			Area			Weighted		
	CF	2005	2005/CF	CF	2005	2005/CF	CF	2005	2005/CF
Belarus	19.6	26.7	1.36	15.3	24.3	1.59	26.7	36.8	1.38
Tajikistan	50.0	64.5	1.29	39.8	52.4	1.31	71.4	93.5	1.31
Kyrgyz Republic	39.8	51.0	1.28	31.0	40.2	1.30	56.8	73.5	1.29
Moldova	27.3	34.7	1.27	21.3	27.9	1.31	37.2	47.6	1.28
Georgia	27.9	35.3	1.27	22.1	30.8	1.39	38.9	48.8	1.25
Latvia	18.9	23.1	1.22	15.5	20.8	1.34	25.4	30.9	1.21
Namibia	49.0	59.9	1.22	36.5	51.3	1.41	75.2	89.3	1.19
Ukraine	19.2	23.5	1.22	16.7	24.8	1.48	26.7	32.8	1.23
Papua New Guinea	55.6	67.1	1.21	45.2	61.3	1.36	78.7	95.2	1.21
Azerbaijan	30.6	36.9	1.21	26.4	36.4	1.38	42.6	51.0	1.20
Marshall Islands	82.0	98.0	1.20	60.2	87.0	1.44	113.6	129.9	1.14
Estonia	19.7	23.5	1.19	15.9	20.8	1.31	26.2	31.1	1.18
Kazakhstan	32.3	38.5	1.19	28.5	39.8	1.40	47.2	56.2	1.19
Turkmenistan	46.9	55.9	1.19	40.5	50.5	1.25	68.0	80.6	1.19
Lithuania	16.9	20.1	1.19	14.7	19.4	1.32	22.5	26.7	1.18
Micronesia. Fed. Sts.	82.6	98.0	1.19	61.0	85.5	1.40	116.3	133.3	1.15
Palau	87.0	103.1	1.19	61.3	84.0	1.37	125.0	142.9	1.14
Uzbekistan	41.2	48.8	1.19	38.8	49.5	1.28	58.5	69.4	1.19
Armenia	30.7	36.2	1.18	26.7	33.4	1.25	41.5	49.0	1.18
Eritrea	73.0	85.5	1.17	56.8	67.1	1.18	108.7	128.2	1.18
Mauritania	65.8	74.1	1.13	48.1	55.6	1.16	100.0	112.4	1.12
Central African Republic	68.5	76.9	1.12	50.5	57.8	1.14	105.3	117.6	1.12
Niger	57.1	64.1	1.12	43.5	50.5	1.16	86.2	96.2	1.12
Bosnia and Herzegovina	32.1	35.7	1.11	31.4	36.0	1.14	43.3	48.5	1.12
Tunisia	21.3	23.7	1.11	19.7	23.8	1.21	28.7	31.8	1.11
Mali	56.5	62.5	1.11	45.5	52.6	1.16	84.7	93.5	1.10
Gambia. The	63.3	69.9	1.10	47.6	54.3	1.14	91.7	101.0	1.10
Sierra Leone	63.7	69.9	1.10	49.5	56.5	1.14	93.5	102.0	1.09
Chad	54.3	59.5	1.10	44.1	50.5	1.15	80.6	88.5	1.10
Djibouti	61.7	67.6	1.09	47.8	54.1	1.13	89.3	97.1	1.09
Algeria	26.2	28.7	1.09	26.4	31.6	1.20	37.3	41.0	1.10
Morocco	22.2	24.3	1.09	21.9	26.0	1.19	30.6	33.4	1.09
Guinea	55.9	61.0	1.09	46.1	52.6	1.14	81.3	88.5	1.09
Vanuatu	117.6	128.2	1.09	94.3	108.7	1.15	175.4	188.7	1.08
Sudan	48.3	52.6	1.09	48.3	55.6	1.15	71.4	77.5	1.09
Togo	53.8	58.5	1.09	46.1	52.4	1.14	76.9	82.6	1.07
Burkina Faso	49.5	53.8	1.09	43.5	49.8	1.14	71.4	76.9	1.08
Libya	34.1	36.9	1.08	35.2	41.8	1.19	48.8	52.6	1.08
Guyana	64.9	69.9	1.08	45.5	49.5	1.09	98.0	105.3	1.07
Benin	46.9	50.3	1.07	41.8	46.7	1.12	66.7	70.9	1.06
Dominica	57.8	61.7	1.07	45.5	49.8	1.09	78.7	82.6	1.05
Comoros	87.7	93.5	1.07	80.0	87.7	1.10	122.0	126.6	1.04
Senegal	43.3	46.1	1.06	42.7	48.5	1.14	60.6	64.1	1.06
Madagascar	66.2	70.4	1.06	61.0	67.6	1.11	97.1	102.0	1.05
Croatia	16.8	17.9	1.06	18.1	19.5	1.08	21.9	23.3	1.06
Gabon	46.5	49.3	1.06	45.9	50.8	1.11	65.8	69.4	1.06
Kiribati	137.0	144.9	1.06	106.4	114.9	1.08	204.1	212.8	1.04
Zimbabwe	60.6	64.1	1.06	50.3	54.1	1.08	88.5	92.6	1.05
Macedonia. FYR	28.5	30.0	1.05	25.4	26.7	1.05	38.0	40.0	1.05
Solomon Islands	102.0	107.5	1.05	75.2	81.3	1.08	153.8	161.3	1.05
Serbia	28.0	29.5	1.05	30.8	32.8	1.07	38.2	40.2	1.05
Belize	54.6	57.5	1.05	41.7	44.6	1.07	76.9	80.6	1.05
St. Kitts and Nevis	48.8	51.3	1.05	43.1	46.7	1.08	62.5	64.9	1.04
Lesotho	61.0	64.1	1.05	50.5	54.3	1.08	87.0	90.9	1.05
Malawi	60.6	63.7	1.05	54.3	59.2	1.09	86.2	90.1	1.05
Malta	17.3	18.2	1.05	19.5	21.8	1.12	20.7	21.6	1.04
Jordan	29.2	30.7	1.05	27.5	29.9	1.09	39.8	41.5	1.04
Côte d'Ivoire	38.9	40.8	1.05	41.7	46.1	1.11	54.3	56.8	1.05
Cameroon	38.5	40.3	1.05	38.6	42.2	1.09	54.3	56.8	1.05
St. Vincent	51.0	53.5	1.05	44.4	48.3	1.09	66.2	68.5	1.03
Ghana	41.7	43.7	1.05	41.5	45.2	1.09	58.1	60.6	1.04
Zambia	57.1	59.9	1.05	52.6	57.1	1.09	82.6	86.2	1.04
Grenada	48.5	50.8	1.05	43.7	47.4	1.09	62.1	64.1	1.03
Antigua and Barbuda	42.6	44.4	1.04	41.2	44.4	1.08	53.8	55.2	1.03
Slovenia	15.0	15.6	1.04	16.3	17.3	1.06	19.2	20.0	1.05

continued on next page

Internal Distance Country	Wei			Area			Weighted		
	CF	2005	2005/CF	CF	2005	2005/CF	CF	2005	2005/CF
Slovak Republic	13.4	14.0	1.04	14.9	16.0	1.07	17.1	17.8	1.04
Uganda	46.1	48.1	1.04	46.1	50.0	1.09	64.5	67.1	1.04
Bhutan	80.6	84.0	1.04	61.3	64.9	1.06	123.5	128.2	1.04
St. Lucia	44.4	46.3	1.04	42.4	45.9	1.08	56.5	58.5	1.04
Tanzania	47.2	49.0	1.04	46.5	50.0	1.08	67.6	69.9	1.03
Seychelles	61.7	64.1	1.04	68.0	72.5	1.07	78.7	80.6	1.02
Philippines	19.0	19.7	1.04	24.3	27.4	1.13	25.7	26.5	1.03
Lao PDR	71.9	74.6	1.04	58.5	61.7	1.06	106.4	109.9	1.03
Lebanon	22.9	23.8	1.04	27.9	30.1	1.08	29.7	30.5	1.03
Swaziland	47.4	49.0	1.03	43.7	46.3	1.06	64.5	66.2	1.03
Tonga	109.9	113.6	1.03	105.3	111.1	1.06	149.3	151.5	1.02
Kenya	41.2	42.6	1.03	44.4	47.8	1.08	57.8	59.5	1.03
Cyprus	20.2	20.9	1.03	23.4	25.1	1.08	25.8	26.5	1.03
Russian Federation	13.5	13.9	1.03	24.8	26.1	1.05	19.3	20.0	1.03
Guinea-Bissau	80.6	83.3	1.03	59.5	61.7	1.04	122.0	126.6	1.04
Botswana	46.1	47.6	1.03	42.7	45.5	1.06	64.5	66.2	1.03
Syrian Arab Republic	26.7	27.5	1.03	34.1	37.0	1.09	35.8	36.9	1.03
Equatorial Guinea	45.5	46.9	1.03	53.2	56.5	1.06	61.3	62.9	1.03
Yemen. Rep.	51.5	53.2	1.03	55.6	58.8	1.06	74.1	75.8	1.02
Cambodia	50.0	51.5	1.03	47.4	50.3	1.06	69.9	71.4	1.02
Maldives	46.5	47.8	1.03	50.5	53.5	1.06	57.5	58.5	1.02
Jamaica	28.9	29.6	1.02	33.8	35.6	1.05	37.0	37.6	1.02
Congo. Rep.	22.9	23.4	1.02	43.1	47.4	1.10	27.4	27.8	1.01
Oman	28.2	28.9	1.02	32.8	34.2	1.04	38.5	39.1	1.02
Bangladesh	20.5	21.0	1.02	26.8	28.2	1.05	27.3	27.9	1.02
Pakistan	20.4	20.9	1.02	24.4	25.6	1.05	28.2	28.8	1.02
Fiji	55.9	57.1	1.02	62.9	66.2	1.05	73.5	74.6	1.01
Barbados	27.8	28.4	1.02	33.8	35.6	1.05	33.2	33.8	1.02
Nigeria	21.8	22.3	1.02	28.7	30.2	1.05	30.2	30.8	1.02
Samoa	108.7	111.1	1.02	105.3	109.9	1.04	147.1	149.3	1.01
Suriname	70.9	72.5	1.02	56.8	58.8	1.04	103.1	105.3	1.02
Trinidad and Tobago	21.5	21.8	1.02	28.2	29.3	1.04	26.7	27.0	1.01
Mauritius	28.1	28.6	1.02	37.9	39.4	1.04	34.4	34.7	1.01
Israel	10.1	10.3	1.02	14.4	14.9	1.04	12.8	12.9	1.01
Cape Verde	74.1	75.2	1.02	74.1	75.8	1.02	100.0	101.0	1.01
Czech Republic	11.6	11.7	1.01	13.6	13.9	1.02	15.0	15.2	1.01
Sri Lanka	27.6	28.0	1.01	35.8	37.0	1.03	36.4	36.8	1.01
Timor-Leste	129.9	131.6	1.01	108.7	109.9	1.01	192.3	192.3	1.00
Vietnam	31.3	31.7	1.01	41.2	42.4	1.03	43.5	43.9	1.01
Qatar	15.2	15.4	1.01	20.6	21.1	1.03	19.0	19.2	1.01
Brunei Darussalam	27.8	28.1	1.01	36.8	37.9	1.03	34.6	35.0	1.01
Rwanda	54.9	55.6	1.01	54.3	54.6	1.01	75.2	75.8	1.01
United Kingdom	4.2	4.2	1.01	6.5	6.7	1.02	5.5	5.6	1.01
Sao Tome and Principe	108.7	109.9	1.01	87.7	88.5	1.01	156.3	158.7	1.02
Bahrain	14.4	14.6	1.01	20.2	20.7	1.03	16.9	17.1	1.01
Kuwait	12.3	12.4	1.01	17.7	18.1	1.03	15.5	15.6	1.01
United Arab Emirates	13.4	13.6	1.01	19.3	19.8	1.02	17.5	17.6	1.01
Egypt. Arab Rep.	22.8	23.0	1.01	27.5	27.7	1.01	31.5	31.8	1.01
France	4.8	4.9	1.01	7.4	7.5	1.01	6.5	6.5	1.01
Angola	41.5	41.8	1.01	49.8	50.3	1.01	58.5	58.8	1.01
India	11.4	11.5	1.01	17.1	17.5	1.02	16.1	16.2	1.01
Burundi	74.1	74.6	1.01	62.5	63.3	1.01	105.3	106.4	1.01
Malaysia	17.2	17.3	1.01	24.7	25.1	1.02	23.1	23.3	1.00
Mongolia	67.1	67.6	1.01	47.4	47.4	1.00	102.0	102.0	1.00
Mozambique	51.0	51.3	1.01	54.9	55.2	1.01	70.4	70.4	1.00
South Africa	14.4	14.5	1.00	26.2	26.2	1.00	19.4	19.5	1.00
Hong Kong. China	5.3	5.3	1.00	8.6	8.6	1.01	6.1	6.1	1.00
Singapore	5.8	5.8	1.00	9.3	9.4	1.01	6.6	6.6	1.00
Congo. Dem. Rep.	21.9	22.0	1.00	51.8	51.8	1.00	26.0	26.0	1.00
Indonesia	17.5	17.5	1.00	26.5	26.6	1.01	24.3	24.3	1.00
Macao. China	9.5	9.5	1.00	14.7	14.7	1.00	10.2	10.2	1.00
Netherlands	5.4	5.4	1.00	8.1	8.1	1.00	6.9	6.9	1.00
Italy	5.0	5.0	1.00	7.9	7.9	1.00	6.6	6.6	1.00
United States	3.2	3.2	1.00	6.5	6.5	1.00	4.5	4.5	1.00
Argentina	15.3	15.3	1.00	31.9	31.9	1.00	20.5	20.5	1.00
Australia	15.5	15.5	1.00	24.9	24.9	1.00	22.2	22.2	1.00
Chile	21.8	21.8	1.00	31.0	30.9	1.00	29.9	29.9	1.00
China	8.3	8.3	1.00	14.3	14.2	1.00	11.8	11.8	1.00
Costa Rica	29.0	29.0	1.00	37.2	37.2	1.00	37.7	37.7	1.00
Dominican Republic	24.5	24.5	1.00	32.7	32.6	1.00	31.7	31.7	1.00
Haiti	45.7	45.7	1.00	46.3	45.9	0.99	60.6	60.6	1.00
Japan	3.4	3.4	1.00	5.8	5.8	1.00	4.5	4.5	1.00
Korea. Rep.	6.1	6.1	1.00	9.9	9.9	1.00	7.9	7.9	1.00
Nicaragua	51.8	51.8	1.00	48.3	48.1	1.00	71.4	71.4	1.00

continued on next page

Internal Distance Country	Wei			Area			Weighted		
	CF	2005	2005/CF	CF	2005	2005/CF	CF	2005	2005/CF
New Zealand	19.6	19.6	1.00	30.5	30.4	1.00	26.0	26.0	1.00
Peru	28.1	28.1	1.00	37.2	37.0	1.00	39.1	39.1	1.00
Portugal	11.4	11.4	1.00	16.2	16.2	1.00	14.9	14.9	1.00
Paraguay	54.3	54.3	1.00	50.8	50.5	0.99	76.9	76.3	0.99
Uruguay	36.5	36.5	1.00	38.8	38.6	1.00	49.0	49.0	1.00
Germany	4.1	4.1	1.00	6.5	6.4	1.00	5.5	5.5	1.00
Spain	6.8	6.8	1.00	10.6	10.6	1.00	9.2	9.2	1.00
Switzerland	6.8	6.8	1.00	9.6	9.5	1.00	8.7	8.7	1.00
Canada	9.5	9.5	1.00	13.7	13.6	1.00	13.3	13.3	1.00
Greece	10.1	10.0	1.00	14.8	14.7	1.00	13.2	13.2	1.00
Ireland	10.2	10.2	1.00	14.0	13.9	0.99	13.2	13.2	1.00
Mexico	10.8	10.8	1.00	16.3	16.2	1.00	15.0	15.0	1.00
Sweden	11.0	11.0	1.00	15.3	15.3	1.00	14.8	14.8	1.00
Norway	11.2	11.2	1.00	15.6	15.5	0.99	15.0	15.0	1.00
Belgium	6.4	6.4	1.00	8.7	8.6	1.00	8.2	8.2	1.00
Austria	6.8	6.8	1.00	11.4	11.3	0.99	8.7	8.6	1.00
Brazil	13.7	13.6	1.00	21.4	21.4	1.00	19.6	19.6	1.00
Saudi Arabia	15.0	14.9	1.00	23.8	23.6	0.99	20.7	20.6	1.00
Denmark	8.2	8.2	1.00	11.5	11.5	1.00	10.5	10.4	1.00
Thailand	16.9	16.9	1.00	25.1	25.0	1.00	22.8	22.8	1.00
Finland	9.7	9.7	1.00	17.9	17.7	0.99	12.5	12.4	1.00
Venezuela. RB	20.1	20.1	1.00	28.0	27.9	1.00	27.6	27.6	1.00
Luxembourg	10.8	10.7	1.00	12.4	12.3	0.99	13.4	13.4	1.00
Poland	10.8	10.8	1.00	14.5	14.3	0.99	14.4	14.4	1.00
Turkey	11.0	10.9	1.00	16.1	16.0	1.00	14.9	14.9	1.00
Colombia	22.4	22.4	1.00	30.3	30.2	1.00	31.0	31.0	1.00
El Salvador	26.3	26.2	1.00	33.9	33.9	1.00	33.4	33.4	1.00
Hungary	13.4	13.4	1.00	16.9	16.7	0.99	17.5	17.5	1.00
Guatemala	28.0	27.9	1.00	34.5	34.4	1.00	37.0	37.0	1.00
Ecuador	29.4	29.3	1.00	37.3	37.2	1.00	39.5	39.5	1.00
Albania	31.0	30.9	1.00	31.1	30.7	0.99	41.2	40.8	0.99
Iceland	32.4	32.3	1.00	35.3	35.1	0.99	43.7	43.5	1.00
Romania	16.9	16.9	1.00	21.2	21.0	0.99	22.7	22.6	1.00
Panama	34.2	34.1	1.00	41.5	41.3	1.00	45.5	45.5	1.00
Honduras	41.8	41.7	1.00	44.6	44.4	1.00	56.2	56.2	1.00
Bulgaria	23.5	23.4	1.00	24.6	24.4	0.99	31.4	31.3	1.00
Iran. Islamic Rep.	23.5	23.4	1.00	33.1	32.9	0.99	33.3	33.2	1.00
Bolivia	56.2	55.9	0.99	51.5	51.3	0.99	80.6	80.6	1.00
Ethiopia	66.7	66.2	0.99	70.4	69.4	0.99	97.1	97.1	1.00
Nepal	43.1	42.7	0.99	41.8	41.3	0.99	59.5	59.2	0.99
Liberia	114.9	113.6	0.99	88.5	86.2	0.97	178.6	175.4	0.98
Afghanistan	66.7	65.8	0.99	59.9	58.8	0.98	98.0	97.1	0.99

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